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Comparative Costs in Agricultural Commodities Among Major Exporting Countries

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Summary

U.S. competitiveness in agricultural commodities has been of major interest recently because of the declining U.S. share in world agricultural trade. Competitiveness, defined as the ability of a country to achieve a market share, is determined by a number of factors which affect the excess supply and excess demand conditions on the world market.

On the supply side, production and marketing costs are the principal factors affecting competitiveness. Government policies, however, are also important since both agricultural and non-agricultural policies (taxes or subsidies) that affect market operations determine in part the cost of production structure for an individual country. These costs, as modified by policies, are termed "policy market costs." They reflect the cost of doing business in the real world and are somewhat different than free market costs which would exist in a market free of intervention. The policies are also amenable to change should a country wish to alter its competitive position.

This study deals with comparative costs of producing and marketing corn, wheat and soybeans for four middle-income countries (Argentina, Brazil, South Africa, Thailand) and five high-income countries (Canada, France, United Kingdom, United States). As noted above, policy market costs are used as reported by each country, thus reflecting natural endowments and technology level as well as specific government policies. For most countries, production costs represent farmer experience over several years in the early to mid 1980s, adjusted for inflation and converted to dollar equivalents at mid-1986 exchange rates. Mean real exchange rates over seven years (1980-86) are used in a comparison analysis to test the sensitivity of the results to changes in exchange rates.

Among the countries studied, Thailand is the lowest-cost producer of corn, and Argentina of wheat and soybeans. The U.S. appears to be a high-cost producer, particularly of wheat and soybeans. Production costs are the major component of landed costs (i.e., f.o.b. plus international freight). The major factors giving rise to cost differences between low-cost producers (e.g., Argentina) and high-cost producers (e.g., the U.S.) appear to be fertilizer, general overhead, capital replacement and land costs. In general, cost advantages among the countries are due mainly to production costs, and not marketing or international freight charges.

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1. Introduction

The issue of competitiveness in export markets is a subject of major concern to a broad range of U.S. agricultural interests. This concern has been focused by the rapid decline in U.S. market share in grains and oilseeds. This decline, coupled with significantly lower world prices, is forcing a restructuring of the asset base in U.S. agriculture. As part of this restructuring process, it is important to understand clearly the competitive advantages and disadvantages of U.S. agriculture.

Farm level costs of production, developed from individual fixed and variable cost components are the basic foundation upon which cost competitiveness is determined. Marketing costs to assemble, store, transport and load ships at export terminals and international freight to bring the commodity to the destination market are the other two major cost components. Depending on a variety of differences in natural resource endowments, infrastructure, distance from market and not least, government policies, each competing country will have a unique cost position in world markets. Some of these cost differences are largely intractable. Others are more easily altered by policy.

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Government policies, both agricultural and non-agricultural policies, can either enhance or distract from the competitive situation that would exist in a free market. In fact, there is so much market interference in both importing and exporting countries, that it is meaningless to try to determine free market economic costs of production as a basis for establishing competitiveness in international markets. Rather, in this study we use "policy market costs," recognizing that most input costs reflect some level of government policy interference.

The recent decline in U.S. world market share has been attributed to a number of factors including, for example, the strong dollar, a weak world economy, enhanced competitiveness of other countries, an increase in trade agreements, and price supports that allow other countries to undersell the U.S. During the 1981/82 to 1985/86 period, for example, the U.S. share of world wheat trade declined from 48% to 29%, corn exports fell from a dominant 75% of world trade to 57%, and U.S. world market share of soybeans and soybean products dropped from 68% to 60%.

Several studies on U.S. competitiveness have been completed or are underway. We have drawn from these where possible. For example, Stanton (1985) compiled a comprehensive report on the cost competitiveness of U.S. agricultural commodities with those produced by countries of the European Community (E.C.). While the U.S. appeared to have a comparative cost advantage in corn production, some major E.C. countries, for example, the U.K. and France, had a cost advantage in wheat production (pp. 63,64,71,82,83). At present the Economic Research Service (ERS) of the USDA is compiling comprehensive reports on the competitiveness of U.S. wheat in the international market (Davies).

In this study the cost competitiveness of the U.S. in the corn, wheat and soybean markets relative to other major exporting (competing) countries is analyzed. These three commodities have accounted for 85-90 percent of the value of U.S. agricultural exports in recent years. Total costs of supplying the above three commodities from various exporting countries to two reference markets, namely Rotterdam and Japan, are determined. Differences in total landed costs may be due to production costs, internal marketing costs or international freight. Included in the study are four middle-income countries (Argentina, Brazil, South Africa and Thailand) and five high-income countries (the U.S., Canada, Australia, the U.K. and France). Because of their relative importance in determining cost competitiveness, specific attention is given to the impact of land rents and exchange rates on country level costs.

Geographic separation of markets is one factor affecting cost competitiveness. While exporting countries are widely distributed around the world, the major markets, i.e., Japan, Western Europe, USSR, are located in the North. In most cases, this gives a transport cost advantage to agricultural exporting countries located in the North.

Each of the countries studied is a major producer and exporter of one or more of the three commodities. The U.S. and Argentina are major exporters of all three and the U.S. is dominant in each market. Canada, France and Australia are important exporters of wheat, and France and Thailand significant exporters of corn. Brazil is a major exporter of soybeans and a major importer of wheat and occasionally some corn and the E.C. a major importer of soybeans.

In Table 1 the mean shares of the world corn, wheat and soybean markets are summarized for the nine countries over the period 1982-84. These nine

countries together account for about 90% of the world exports of the three commodities studied.

Table 1. Exports and Mean Shares of World Corn, Wheat and Soybean Markets by Various Countries 1982-84.

Country	Commodities		
	Corn	Wheat	Soybean equivalents*
	Million Metric Tons		
World	69.16	111.01	45.17
Argentina	5.76	7.16	4.23
Australia	0.02	9.98	--
Brazil	0.50	0.00	10.30
Canada	0.56	21.16	--
France	4.28	14.40	--
South Africa	1.75	0.10	--
Thailand	2.85	0.0	--
United Kingdom	0.01	2.06	--
United States	48.56	42.11	29.41
	% of World total		
Argentina	8.3	6.4	9.4
Australia	0.0	9.0	--
Brazil	0.7	0.0	22.8
Canada	0.8	19.1	--
France	6.2	13.0	--
South Africa	2.5	0.1	--
Thailand	4.1	0.0	--
United Kingdom	0.0	1.9	--
United States	70.2	37.9	65.1
Total	92.8	87.4	97.3

Source: Food and Agriculture Organization of the United Nations, pp. 112-14, 123-25, 210-11, 240-41, 269-70.

*Trade in soybean products from non-producing countries is not included.

2. Competitiveness defined

A great deal of confusion has arisen about the term "competitiveness." Perkins defined competitiveness as an ability to achieve a market share. Thus, a country becomes more competitive when its share of the export market increases, and vice versa. A number of factors influence a country's competitiveness, for example, the marginal costs (supply functions) of the country concerned and its competitors, and excess demand functions of importing countries. A shift in the excess demand function of a major importer, for example, will influence the market shares of the exporter when there are differences in the price elasticities among the exporters' excess supply functions. These functions include farm production and internal marketing costs, and are affected by government intervention through taxes and subsidies. Changes in these factors can have a major effect on competitiveness (Sharples).

In this study "cost competitiveness" is defined as the ability of farmers in a country to compete with farmers in another country in terms of production and marketing costs of agricultural commodities. Policy market costs reflect natural endowments and technology level as well as specific government policies. They are part of the overall competitiveness equation on the supply side, and reference will be made to "cost competitiveness" of a country, or a country has a "comparative cost advantage" in a certain commodity. Detailed production and marketing costs are useful in that they reflect differences in production and marketing structure, technology and policy among countries and they show which costs are most important in each country.

Production and marketing costs provide a short run picture of a commodity market. Assumptions are that production and marketing infrastructure is given, technology is known, investment in the sector is fixed, variable input prices

are given, and demand is fairly stable. Major factors influencing a country's long run competitiveness include natural endowments, public and private investment, opportunity cost of inputs, technology, domestic demand shifts, and public policies which influence the last four factors (Sharples).

3. Methodology

Three types of costs are considered in getting commodities to final external markets: production or farm gate costs, internal marketing costs (from the farm gate onto a ship), and international freight or shipping costs (from the exporting port, f.o.b., to the importing port). The process used for determining each of these cost components is described below.

3.1 Production costs

These costs are presented in some detail for the various products and exporting countries. To make a meaningful comparison of production costs among countries they must be placed on a common basis. Factors that complicate comparative cost analyses among countries include (1) different methods of collecting and reporting cost data (data availability), (2) different inflation rates among countries and (3) changes in exchange rates over time.

Within each country there are difficulties in obtaining representative cost data since crop growing conditions often vary considerably from region to region and difficulties exist in allocating fixed costs (e.g., machinery depreciation and general overhead) to individual enterprises. The last two aspects are basic to making production cost studies and are not discussed further. The first three aspects are discussed briefly below.

3.1.1 Data availability

Methods of collecting and reporting cost data vary among countries. The U.S. has the most comprehensive cost of production studies in the form of

USDA Economic Research Service (ERS) enterprise budgets. For every commodity a national average as well as regional averages for major producing areas are presented annually. In this study U.S. mean production costs of corn, wheat and soybeans were based on six years of ERS budget data (1980-85). Overall U.S. cost averages as well as mean costs for major regions producing corn (Corn Belt), wheat (Central Plains) and soybeans (Corn Belt) were calculated.

Of the other high-income countries considered, the U.K. has some of the best data available in the form of the University of Cambridge Annual Farm Reports. U.K. winter wheat production costs were based on two years of data(1982 and 1984) presented by Stanton (p. 80).

Australia, Canada and France do not have similar detailed production cost data as the U.S. or U.K., thus complicating comparative cost studies. Annual crop budgets are established by various organizations. Data presented in this study for Australia and Canada are based on the best data available to country specialists at the USDA (Byrne; Johnston; Goodloe). For Australia, the 10-year mean wheat yield was used because of severe droughts in the 1980's. Australia's wheat yields showed no marked trends over the years 1948-79 (Longworth and Knopke, p. 646). For France, wheat and corn production costs were based on three years of data (1980-82) derived by Stanton (pp. 58-61, 68-69) for the Paris Basin.

Of the middle-income countries, South Africa had the most comprehensive production cost data available for corn and wheat. Soybeans at present are not an important crop. The Directorate of Agricultural Production Economics conducts annual surveys in major corn and wheat producing areas. Corn and wheat production costs were based on the survey results. For both commodities, six years of data were used (1979/80 - 84/85).

For Argentina, corn, wheat and soybean cost data were derived from official (Argentine) estimates published in 1985 in the "Annual Agricultural Situation Report" (Ahalt), which are the best data available to the USDA (Hazera). Mean yields were derived from actual yields over the last five years in the same Report (1980/81 - 84/85).

For Brazil, budgets established by government organizations were supplemented with data from university surveys. Corn production costs for Thailand were based on five years of data (1980/81 - 84/85) received from the USDA (Schwartz). In general, data were accepted as obtained. However, in certain limited cases, estimates of omitted cost items were made, for example, labor costs and interest on non-land capital in Canada were based on rates for the U.S.

3.1.2 Accounting for inflation

Inflation rates, as measured by the Consumer Price Index (CPI), vary widely among countries and usually vary between years in the same country. In this study production and marketing costs of corn, wheat and soybeans were inflated to a mid-1986 basis using the relevant CPI in each country. To make these costs comparable among countries, the mid-1986 cost estimates were converted to U.S. dollars using mid-1986 exchange rates.

3.1.3 Currency exchange rates

Although floating exchange rates for individual currencies have enhanced world trade, they have complicated analyses of time series data in comparative cost studies (Stanton, p. 16). In the period 1980 to 1985 most currencies depreciated against the U.S. dollar in nominal and real terms, (Goodloe and Byrne, p. 18; Stallings). Various indices, such as the Federal Reserve's weighted-average exchange value index (which measures movements of

the dollar against currencies of the ten largest market economies) and the index of the agricultural trade-weighted dollar, show that the U.S. dollar reached a peak during 1985 (Economic Research Service, 1986, pp. 17, 19). From February 1985 to February 1986 the nominal commercial rates for the dollar fell 29% against both the Japanese yen and the German mark. However, most agricultural competitor currencies have not strengthened against the U.S. dollar in 1986 (ibid. p. 19). Expectations are that, at least for the near future, both Japan and West Germany will not allow the U.S. dollar to fall much further. In addition, currencies of major agricultural competitors are not expected to appreciate significantly against the U.S. dollar and are expected to remain at roughly their mid-1986 level in the near future. For the above reasons, mid-1986 (i.e., mean of June and July) exchange rates are used to convert production and marketing costs in foreign currencies to U.S. dollars.* The effects of using mean real exchange rates for a 7-year period (1980-86) are also evaluated. This mean incorporates periods of a low dollar value (1980) and a high dollar value (1985).

Table 2 shows the exchange rates of foreign currencies with the U.S. dollar during mid-1986 and the seven-year (1980-86) mean real exchange rates with mid-1986 as the basis. Exchange rates and CPIs were obtained from International Financial Statistics, an International Monetary Fund publication

*Production and marketing costs for each country are representative of one or more years in the 1979-85 period depending on the specific country. The relevant CPI for each country was used to inflate previous years data to a common mid-1986 level prior to converting the costs to dollar equivalents.

Table 2. Mid-1986 exchange rates and mean real exchange rates for 1980-86,* (mid-1986 CPI = 100)

Country	Currency	Exchange rates	
		Mid-1986	1980-86
		(Currency/U.S. Dollar)	
Argentina	australe	0.8889	0.8477
Australia	dollar	1.5132	1.2531
Brazil	cruzado	13.8400	11.9033
Canada	dollar	1.3852	1.3292
France	franc	7.0280	7.4503
South Africa	rand	2.5381	1.8380
Thailand	baht	26.2825	23.0928
United Kingdom	pound	0.6631	0.6464

*Real exchange rates per U.S. dollar were calculated as the nominal exchange rate multiplied by the ratio of the U.S. CPI to the relevant country's CPI (mid-1986 = 100).
Source: International Monetary Fund.

3.2 Internal domestic marketing costs

The costs of marketing corn, wheat and soybeans include handling, storage, transport and port handling costs, i.e., the costs of transferring the products from the farm gate to the export ports and onto the ships. They represent the difference between the "free-on-board" (f.o.b.) price and the farm gate price. For the countries listed below, sources of marketing costs are given in parenthesis: Argentina (Ahalt), Brazil (Miranda), South Africa (Louw), Thailand (Smit), U.S. (Lin), Australia (Johnston) and Canada (Goodloe). Marketing costs were estimated for the U.K. and France. For some countries "free-on-rail" (f.o.r.) costs were supplemented with port handling costs estimated from U.S. and Brazil data (Miranda).

For the U.S., Gulf ports were considered the export location, while for Canada it was assumed that exports were shipped along the St. Lawrence River

and via West Coast ports, depending on the destination. For Brazil, the southern ports were considered.

3.3 International freight charges

These form an important component of the landed cost of commodities in world markets. Ocean freight rates fluctuate widely and, as McLennan has pointed out, export competitiveness is not only affected by the level of rates, but the ability to manage freight rate volatility.

Because of the numerous possible export destinations and to facilitate comparisons among countries, two major export destinations were considered, namely Rotterdam and Japan. Although Europe is an important wheat exporter, Rotterdam was taken as a destination since the distance, and hence freight charges, from this region to the Black Sea (U.S.S.R.) would be roughly common for all exporters.

Freight charges for most countries were obtained from data published by the Food and Agriculture Organization of the United Nations (p. 23). Estimates were made for countries for which data were not available, after consulting with experts. Freight rates are depressed at present, and since they are not expected to improve until 1990 (McLennan), the latest data available (for 1984/85) were used.

3.4 Cost of production by wheat type

For most countries, the wheat costs of production used in this study reflect a composite of several types of wheat. Since each wheat type has a specific market as well as unique cost of production and price structure, it is important to determine whether or not the use of a composite cost value introduces a bias into the cost competitive comparisons. Table 3 shows the major types of wheat grown in various exporting countries.

Table 3. Major types of wheat grown in various exporting countries

Country	Major wheat type
Argentina	Hard red winter
South Africa	Hard red winter
United States	Hard red winter
Canada	Hard red spring
Australia	All white winter*
United Kingdom	Soft white winter
France	Soft white winter

*Equivalent to hard red winter in terms of quality (Byrne).

Costs of production by wheat type are available for the U.S. These mean production costs along with prices of various types of wheat in the U.S. for the years 1983-85 are shown in Table 4.

Table 4. Mean production costs and prices of U.S. wheat types, 1983-85

Wheat type	Production costs (including land) ($/mt)	Harvest-period price ($/mt)
	(U.S. dollars per metric ton)	
Hard red winter	143	115
Soft red winter	152	116
Hard red spring	155	129
Durum	162	134
White	136	126

Source: Calculated from Economic Research Service (ERS) data in "Economic Indicators of the Farm Sector: Costs of Production, 1985."

The greatest production cost difference lies between Durum and White wheat and amounts to $26 per ton. Production costs of the other three types, which are

the major ones traded on the world market and comprise the major wheat types in most countries (see Table 3), are similar. Also, there appears to be a strong positive correlation between production costs per ton and prices.

For the above reasons wheat production and marketing costs for various countries were not calculated for each type, but reflect weighted average costs of wheat. Comparisons among countries are based on mean costs.

4. Results

Detailed production costs of corn, wheat and soybeans are presented in Appendices 1, 2 and 3 on a per metric ton basis. Production costs are categorized into variable and fixed costs, where variable costs include cost items that are incurred if production takes place while fixed costs are incurred even if no production takes place in the short run. The costs include cash costs, capital replacement costs and imputed costs on factors such as land, family labor and nonland capital (economic costs). Management and risk costs were not considered. Some economists question whether land should be included in an analysis of this nature. However, land is a factor of production and has opportunity costs. In the long run, all costs, including land, must be covered by farmers to remain in production. Land costs may reflect the relative scarcity or abundance of this factor among countries.

The sum of production and marketing costs are here termed "free-on-board" (f.o.b.) costs.[1] Total landed costs of corn, wheat and soybeans for various countries are the best measure of competitiveness and are discussed next. This is followed by a discussion of the detailed cost breakdown within each country. Finally, two sections deal with the cost competitive implications of varying

[1]The strict definition of f.o.b. cost is the farm gate price plus the marketing costs of getting the product from the farm gate onto a ship.

levels of land rent and exchange rates.

4.1 Landed costs

Total landed costs of corn, wheat and soybeans at the two reference ports, Rotterdam and Japan, for various countries are summarized in Table 5.

Table 5. Total Landed Costs of Corn, Wheat and Soybeans at Rotterdam and Japan for Various Exporting Countries (mid-1986 Price Level and Exchange Rates).

Particulars	f.o.b. cost	Freight rates to		Landed cost at	
		Rotterdam	Japan	Rotterdam	Japan
		($US/metric ton)			
1. Corn					
Argentina	115.68	18.50	32.39	134.18	148.07
Brazil	185.75	16.50	34.20	202.25	219.95
South Africa	143.74	19.40	30.80	163.14	174.54
Thailand	113.08	20.00*	12.00*	133.08	125.08
United States	144.32	12.62	26.00	156.94	170.32
France	233.37	2.00*	29.90	235.36	263.26
2. Wheat					
Argentina	112.10	18.50	32.39	130.60	144.49
South Africa	167.61	19.40	30.80	187.01	198.41
United States	190.08	12.62	26.00	202.70	216.08
Canada	193.13	10.71	19.35	203.84	212.48
Australia	154.87	25.33	19.08	180.20	173.95
United Kingdom	168.65	4.00*	31.00	172.65	199.65
France	197.97	2.00*	29.90	199.96	227.86
3. Soybeans					
Argentina	185.04	18.50	32.39	203.55	217.44
Brazil	241.91	16.50	34.20	258.41	276.11
United States	267.74	12.62	26.00	280.36	293.74

Sources: 1) Appendices 1,2 and 3.
2) Food and Agriculture Organization of the United Nations (p. 23).
*Estimates.

4.1.1 Corn

Of the countries considered, Thailand had the lowest landed costs for corn at both Rotterdam and Japan, namely $133 and $125 per ton, respectively. Argentina showed the second-lowest landed costs at both destinations, with the cost at Rotterdam being only marginally higher than Thailand's. The major reason for Thailand's and Argentina's cost advantage is low production costs which give rise to low f.o.b. costs (see Appendix 1). Reasons for the low production costs will be discussed later. It is noteworthy that two middle-income countries are the lowest cost producers.

The U.S. had the third-lowest landed cost at both destinations, its low freight costs offsetting South Africa's slightly lower f.o.b. cost. South Africa is a relatively small exporter of corn and it may have a comparative cost advantage in selling corn to African countries because of their close proximity.

France is the most important corn producer in the E.C. and its exports averaged 4.2 million tons over the period 1982 - 84. Its relatively high landed costs, even at Rotterdam ($235), are due to high production costs per ton (see also Stanton, pp. 70-73). France's exports are probably limited to the protected, deficit E.C. market.

Brazil has high landed costs at both Rotterdam and Japan. Although Brazil is only a very small and occasional exporter of corn it is a major corn producer and a rapidly growing corn consumer. Its future as an exporter will depend on major cost reduction through yield-increasing technology. If this does not occur then Brazil will be a major future corn market.

4.1.2 Wheat

From Table 5, Argentina has the lowest landed cost for wheat at both Rotterdam and Japan. Argentina has low f.o.b. costs due to low production costs (see Appendix 2). However, Argentina's share of the world wheat market over the period 1982 - 84 was only 6.4%.

As regards the other countries and Rotterdam as destination, the U.K. and Australia have a cost advantage in wheat exports. Low freight rates to Rotterdam give the U.K. a cost advantage; its f.o.b. costs are the fourth-lowest. Australia, apart from Argentina, is a low-cost producer of wheat. France is a high-cost producer and landed costs, even at Rotterdam, are high as a result. Canada shows the highest landed cost at Rotterdam due mainly to high production costs (see Appendix 2). However, Canada's landed costs are similar to the U.S.

With Japan as destination, Australia is second to Argentina and South Africa is third in terms of lowest landed costs per ton. Australia has a freight cost advantage to the Far East. France reflects the highest landed cost at Japan ($228 per ton), followed by the U.S. ($216 per ton). Although the U.S. dominated the world wheat market for a long time (a world market share of 38% over the period 1982-84) it now appears to have a comparative cost disadvantage in the production and export of wheat.

4.1.3 Soybeans

The two middle-income countries, Argentina and Brazil, have a cost advantage in soybean production and exports relative to the U.S. Although the U. S. has lower freight costs to both Rotterdam and Japan, these are more than offset by lower production costs in Argentina and Brazil (see Appendix 3). The

two latter countries have higher marketing costs because of poor infrastructure.

Although the U.S. has been dominating the world soybean market, Brazil, and more recently Argentina, are increasing in importance. Brazil in particular has considerable potential to further increase its soybean production with new technology and because of substantial land resources. Further, since Brazil has a cost disadvantage in corn and wheat production, it will likely continue to be a formidable competitor in soybean markets.

4.2 Production and marketing costs

From the foregoing analysis, production costs generally appear to be the most important element in a country's comparative cost position. This section highlights some of the important cost elements giving rise to differences in production costs. A summary of corn, wheat, and soybean production and marketing costs in various countries is given in Table 6. Detailed production costs are presented in Appendices 1, 2 and 3.

4.2.1 Corn

From Table 6 it is evident that Thailand has the lowest f.o.b. cost per ton of corn due to relatively low production cost of about $113 per ton. These low costs are due mainly to the fact that Thailand farmers have been achieving mean yields of about two tons per hectare using little commercial fertilizer . Corn production is labor and animal intensive which makes it unique among the countries considered.

Argentine farmers, who are also relatively low-cost producers ($116 per ton), use an advanced crop-cattle rotation system, and have fertile soils. Good yields are achieved without the use of commercial fertilizers, which are high-priced because of government-imposed taxes. Argentina also has low chemical, land and capital replacement costs per ton of corn. Export prices

have been subject to a 25% tax resulting in low net farm prices and low land costs. To remain in production farmers use a low-cost strategy. In the event of the government reducing or abolishing taxes on agricultural inputs and export prices, Argentine farmers would probably respond by increasing the use of those inputs. The volume of production could increase substantially.

France shows the highest f.o.b. cost per ton ($233) which is due to high production costs, mainly fixed costs. No detailed cost estimates could be obtained for France, and data were based on Stanton (pp. 68-69). Brazil has the second highest production costs due mainly to high fuel, labor and land costs per ton, primarily from low yields. Labor costs, which are low on a per hour basis, are high per ton because of labor-intensive cultivation and harvesting methods. Brazil also has high marketing costs due to long transport distances and poor infrastructure.

South Africa, with the lowest yield of about two tons per hectare, has an f.o.b. cost similar to the U.S. South Africa's share of the export market is small and it is not expected to increase much due to land and moisture constraints. The U.S., which has higher production costs of about $11 per ton, has relatively low marketing costs due to an efficient infrastructure and the use of subsidized barges to transport corn. Production costs of the Corn Belt are only about $5 per ton less than for the U.S. as a whole.

Table 6. Production and Marketing Costs of Corn, Wheat and Soybeans in Various Countries, (Mid-1986 Prices and Exchange Rates.)

Particulars	Yield Per Ha.	Costs (U.S. $/m. ton)				
		Variable (1)	Fixed (2)	Total Production (3)=(1)+(2)	Marketing (4)	Total f.o.b. (5)=(3)+(4)
	(Tons)	($U.S./metric ton)				
Corn						
Argentina	3.36	45.60	39.62	85.22	30.46	115.68
Brazil	2.22	73.28	75.10	148.38	37.37	185.75
South Africa	1.98	61.12	47.02	108.14	35.60	143.74
Thailand	2.07	43.98	35.18	79.16	33.92	113.08
USA - Overall	6.43	58.70	60.52	119.22	25.10	144.32
USA - Corn Belt	6.77	55.34	59.16	114.50	25.10	139.60
France*	6.88	91.52	109.05	200.57	32.80	233.37
Wheat						
Argentina	1.81	42.26	40.34	82.60	29.50	112.10
Brazil	1.14	223.79	79.36	303.15	41.29	344.44
South Africa	1.46	77.99	57.12	135.11	32.50	167.61
USA - Overall	2.24	68.27	91.21	159.48	30.60	190.08
USA - Central Plains	2.18	54.02	91.76	145.78	34.37	180.15
Canada	1.94	57.66	104.67	162.33	30.80	193.13
Australia	1.50	42.45	77.02	119.47	35.40	154.87
United Kingdom	6.98	66.62	72.03	138.65	30.00	168.65
France*	6.36	48.36	116.81	165.17	32.80	197.97
Soybeans						
Argentina	2.10	79.80	69.10	148.90	36.14	185.04
Brazil - with wheat	1.80	117.35	67.45	184.80	43.50	228.30
Brazil - without wheat	1.80	121.96	76.45	198.41	43.50	241.91
USA - Overall	1.95	88.36	154.78	243.14	24.60	267.74
USA - Corn Belt	2.27	69.35	154.60	223.95	24.60	248.55

Source: Appendices 1, 2 and 3.

In general, variable costs play a more important role than fixed costs in middle-income countries while fixed costs predominate in the developed countries. Developing countries may thus have greater flexibility in production in that they have less specialized investments (e.g., machinery). Variable inputs such as fertilizer, chemicals and fuel have higher unit prices in developing countries, but prices of land and labor are lower. In Brazil, for example, fertilizer prices in 1985 were about 40% higher than in the U.S., while land prices were about 40% and labor costs about 10% of those in the U.S.

4.2.2 Wheat

Argentina has a comparative cost advantage in wheat production with a f.o.b. cost of $112 per ton. The main contributory factors are no commercial fertilizer costs and low machinery and land costs. Reasons for these low costs are similar to those applicable to corn, and can be attributed largely to government policies such as import and export taxes.

Australia, with a mean yield of 1.5 tons per hectare, has the second lowest cost. The f.o.b. costs of South Africa and the U.K. are similar, with South Africa's lower production costs ($135 per ton) offset somewhat by higher marketing costs of about $32 per ton. South Africa's costs compare favorably since these are based on the main production areas with higher yields. However, South Africa is a relatively small exporter of wheat and will remain so because of land and moisture constraints.

The U.S. shows lower production and f.o.b. costs than Canada, with a cost difference of about $3 per ton. Production costs on the Central Plains, the primary wheat producing area in the U.S., are about $14 lower than the U.S. overall production costs. Moreover, f.o.b. costs are only $10 lower due to higher marketing costs of the hard red winter wheat from the Central Plains.

In Brazil, wheat is primarily a winter crop and is double-cropped with soybeans. Brazil has a cost disadvantage in wheat production mainly because of environmental constraints and poor technology. High production costs are due to high variable costs (mainly seed, fertilizer, chemicals and fuel costs) relative to yield. Marketing costs are also relatively high due to long transport distances to ports and poor infrastructure.

Total variable costs are dominant in middle-income countries (mean 59%) and fixed costs in developed countries (mean 60%). High-income countries have a higher investment in machinery as is evident by the capital replacement figure, and tend to have higher labor and land costs per ton.

4.2.3 Soybeans

From the cost estimates in Table 6, both Argentina and Brazil have a substantial competitive advantage in production costs relative to the U.S. Variable costs in Argentina are low since little or no commercial fertilizers are used. Custom operation costs are high because most farmers in Argentina use contractors to harvest their crop. However, these high costs are partly offset by relatively low machinery costs per ton. In both Argentina and Brazil, fixed costs are substantially lower than in the U.S. This is the main reason for the two developing countries' comparative cost advantage. Lower production costs more than offset the relatively high marketing costs in Argentina and Brazil.

In Brazil, about 20% of soybeans are double-cropped with wheat. Brazil has relatively high variable costs which are due to high fertilizer prices and greater requirements per hectare of P_2O_5. In general, variable costs are dominant in the middle-income countries while fixed costs account for 64% of total production costs in the U.S. Chemicals, machinery and land are mainly responsible for the high cost of soybean production in the U.S. Corn Belt

soybean farmers produce their crop at a 8% lower cost than the "average" U.S. farmer.

5. Cost comparisons in Argentina and the U.S.

This section deals briefly with the main factors which give rise to the cost differences between Argentina, a low cost producer of corn, wheat and soybeans, and the U.S., the largest exporter and a relatively high cost producer.

Analyzing the detailed production cost breakdown in Appendices 1, 2 and 3 suggests that fertilizer, general overhead, capital replacement and land costs are the main factors giving rise to overall cost differences. These items are summarized on a per ton and per hectare basis in Table 7. Labor costs are also shown, although cost differences are not substantial.

As was mentioned before, Argentina has a cost advantage in that farmers achieve a good yield with use of little or no commercial fertilizers. Land prices in the U.S. (in 1985) are over three times those in Argentina. Land is a residual claimant of profits and high U.S. land prices may simply reflect support price policies while in Argentina they reflect high export taxes which have reduced the net price to farmers. U.S. land prices have fallen sharply since 1980 reflecting substantially lower commodity prices.

Table 7. Selected cost inputs for corn, wheat and soybean production in Argentina and the U.S., (mid-1986 prices and exchange rates)

Particulars	Corn		Wheat		Soybeans	
	Argentina	U.S.	Argentina	U.S.	Argentina	U.S.
Yield/ha.(m. tons)	3.36	6.43	1.81	2.24	2.10	1.95
	($US/metric ton)					
Fertilizer	--	22	--	21	--	13
General overhead	--	7	--	10	--	15
Capital replacement	6	14	7	25	11	33
Land	14	22	16	27	22	63
Labor	8	6	7	13	14	19
	Per Ha		Per Ha		Per Ha	
Fertilizer	--	144	--	48	--	25
General overhead	--	45	--	22	--	28
Capital replacement	21	89	12	57	23	64
Land	47	145	28	60	47	123
Labor	27	40	13	28	29	36

Capital replacement is another controversial cost factor, the controversy usually centering on the useful life of a machine. The ERS has used engineering data in its calculations. Information from other countries is ambiguous. Capital replacement figures represented here reflect data received from country specialists at the USDA. More research is needed into how the capital replacement figures were derived. It was assumed here that the figures obtained correctly reflect the life periods of machines in the countries concerned. The main factor for the large replacement cost differences between Argentina and the U.S. may be due to the specialized, high-cost nature of machines on American farms. Alternatively, it may be that the useful life of U.S. farm machinery has been underestimated. Argentine farmers make greater use of custom operations but these are more than offset by high ownership costs in the U.S.

General overhead is a noteworthy item. Although Argentine data shows no cost under this category, there may be some cost, albeit small. The U.S. shows a significant cost, e.g., $45 per hectare for corn. According to the ERS general overhead includes electricity for general farm use, telephone, office supplies, fees and dues, water drainage, liability insurance, fence repairs, and general business expenses (Economic Research Service, 1985, p. 16).

The lower part of Table 7 reflects costs per hectare of land. For corn and wheat, higher costs per hectare in the U.S. are not offset by the higher yields per hectare. For soybeans, higher U.S. costs per hectare go together with a lower yield.

It is interesting that labor costs per ton are not much different between the U.S. and Argentina. In fact for corn, labor costs per ton are lower in the U.S., namely $6 versus $8. For wheat and soybeans, labor costs per ton for Argentina are $7 and $14, respectively. It appears, therefore, that labor is not a factor giving rise to major cost differences per ton between the two countries.

6. Effects of changing exchange rates

The impacts of changing exchange rates on the rankings of exporting countries in terms of f.o.b costs is shown in Table 2, where seven-year mean real exchange rates are presented. These mean exchange rates incorporate periods of a low-valued dollar (1980) and a high-valued one (1985), and may reflect long term relationships between the U.S. dollar and other currencies. The impacts of the mean exchange rates on the rankings of countries in terms of f.o.b. costs are evaluated and compared with the rankings during mid-1986. Results are given in Table 8.

Table 8. F.o.b. costs of corn, wheat and soybeans in various countries, mid-1986 and 1980-1986 mean real exchange rates, CPI mid-86 = 100 (U.S. dollars per metric ton).

Country	f.o.b. cost (U.S. $/mt) mid-1986 $/t	mid-1986 ranking	1980-1986 $/t	1980-1986 ranking
1. Corn				
Argentina	116	2	121	1
Brazil	186	5	216	5
South Africa	144	3	199	4
Thailand	113	1	129	2
United States	144	3	144	3
France	233	6	220	6
2. Wheat				
Argentina	112	1	118	1
Brazil	344	8	400	8
South Africa	168	3	231	7
United States	190	5	190	5
Canada	193	6	201	6
Australia	155	2	187	3
United Kingdom	169	4	173	2
France	198	7	187	3
3. Soybeans				
Argentina	185	1	194	1
Brazil	242	2	281	3
United States	268	3	268	2

From Table 8 it appears that the rankings of most countries has not changed markedly under the mean exchange rates when compared with the mid-1986 positions, particularly for corn and soybeans. For corn, Argentina was ranked first, Thailand second, and the U.S. third. For soybeans, the U.S. improved its ranking to second at the expense of Brazil.

For wheat, the changes in the relative positions are more marked. The U.S. maintained its fifth ranking, and Canada its sixth. The U.K. improved from fourth to second, and France from seventh to third, its f.o.b. costs being

similar to Australia's which lost one position. South Africa was the most negatively affected country, its position shifting from third to seventh.

Overall, of the three commodities the U.S. appears most cost competitive in corn and may compete with Brazil for soybeans. However, since Brazil has relatively high f.o.b. costs for corn and wheat, it may have a comparative advantage in soybean production. U.S. farmers, unlike Brazilian farmers, would be more sensitive to relative price changes in corn and soybeans.

The fact that the rankings of most countries had not changed markedly under the two exchange rates, indicates that the mid-1986 position, on which all previous analyses were based, is an acceptable one. Its advantage is that it reflects better the current economic circumstances which are likely to persist into the near future.

7. Conclusions

The fact that the U.S. has been losing its share of world agricultural trade over the past five years has awakened interest in the issue of competitiveness which has been defined as the ability of a country to achieve a market share. This study has dealt with the cost competitiveness of major exporting countries in corn, wheat and soybeans. Production and marketing costs are the principal factors, on the supply side, affecting competitiveness. "policy market costs," as opposed to true economic costs in a free market, were used as these reflect the cost of doing business in the real world.

Of the countries considered, Thailand had the lowest landed costs for corn and Argentina for wheat and soybeans at both Rotterdam and Japan. The major reason was low farm production costs, particularly low commercial fertilizer, machinery and land costs. Argentine farmers achieve good yields with little or no commercial fertilizers because of fertile soils and use of advanced crop-

cattle rotation systems. The abolishment of input taxes may stimulate greater use of inputs and higher yields. The lifting of agricultural export taxes in Argentina would probably increase land prices.

The U.S. dominates the world corn market and is the price setter in that market. This domination may continue for some time as the U.S. has a comparative cost advantage in corn production, apart from Argentina and Thailand. Both Argentina and Thailand, although low-cost producers, are somewhat limited by land and climate constraints but could increase yields with new technologies and favorable government policies. Brazil, although a large corn producer, is a high cost producer and appears to have a comparative advantage in soybean production when compared to the U.S. Brazilian farmers may not be as sensitive to relative corn and soybean price changes as U.S. farmers. In the event of soybean price declines, U.S. farmers may produce more corn and less soybeans, whereas Brazilian farmers may maintain their soybean production levels.

Apart from Brazil, Canada, and France, the U.S. has a competitive disadvantage in wheat. Relatively high production costs (both variable and fixed) are the main cause. The U.S. may lose more of its market share in the future to Argentina, Australia, and some E.C. countries. Apart from Argentina, competition in the world wheat market is at present mainly among developed countries.

With regard to soybeans, it is clear that the two middle-income countries, Argentina and Brazil, have a cost advantage relative to the U.S. Brazil appears to have a comparative advantage in soybean production because of high corn and wheat production costs. It also has considerable potential to expand production because of vast land resources and with the use of new technologies.

Improving infrastructure and port facilities will enhance the middle-income countries' competitive advantage. The U.S. may gradually lose its dominant share of the world soybean market to South American countries, mainly Argentina and Brazil.

Generally, production costs, which are dependent on suitability of soil and climate, technology, management expertise, and government policies appear to be the most important element in determining the cost competitiveness of a country. Variable costs are generally dominant in middle-income countries and fixed costs in high-income countries. Major reasons for production cost differences per ton between developed and developing countries appear to be due to fertilizer, general overhead, capital replacement and land costs.

The U.S. is the major exporter of all three commodities considered and has a major influence on export prices. Also, since the U.S. is a relatively high cost producer, particularly of wheat and soybeans, and since support prices have been above market clearing levels, world prices have tended to be relatively high. This benefits low-cost countries since they are able to capture economic rents.

Most countries have inadequate production cost data, which has complicated this comparative cost study. More research is required in this area as well as 1) the potential for increased production in various countries, 2) the commodities in which a country has a comparative advantage, and 3) the effects of government policies and programs on the cost structures of major export commodities.

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Appendix 1

PRODUCTION AND MARKETING COSTS OF CORN IN VARIOUS COUNTRIES (U.S. DOLLARS, MID-1986 PRICE LEVEL AND EXCHANGE RATE)

	ARGENTINA		BRAZIL		SOUTH AFRICA		THAILAND		UNITED STATES			
Particulars									OVERALL		LAKE STATES AND CORN BELT	
Yield/Hectare (m. tons)	3.36		2.22		1.98		2.07		6.43		6.77	
Variable Costs	Per MT	%	Per MT	%	Per MT	%	Per MT	%	Per MT	%	Per MT	%
Seed	14.06		6.07		4.01		2.77		7.26		7.09	
Fertilizer and Lime	--		28.15		24.45		0.44		22.43		22.57	
Chemicals	0.54		0.48		6.25		0.26		7.55		7.51	
Custom Operations	16.83		--		0.59		21.03		2.70		2.39	
Fuel and Lube	7.17		18.47		11.78		--		7.51		5.40	
Repairs	5.46		4.62		6.65		1.59		4.82		3.94	
Drying	--		--		--		--		2.88		3.19	
Hired Labor	--		--		1.17		15.11		0.66		0.57	
Miscellaneous	--		13.01		3.48		1.11		0.41		0.32	
Interest on Variable Expenses	1.54		2.48		2.74		1.67		2.48		2.36	
Total Variable Cost	45.60	53.5	73.28	49.4	61.12	56.5	43.98	55.6	58.70	49.2	55.34	48.3
Fixed Costs												
General Farm Overhead	--		2.10		1.32		3.39		6.96		6.44	
Taxes and Insurance	6.74		3.79		0.75		--		6.45		6.50	
Capital Replacement	6.16		9.49		13.57		1.99		13.80		12.73	
Labor	8.17		20.82		7.32		15.35		5.63		4.81	
Interest on Nonland Capital	4.58		4.25		6.65		2.63		5.20		4.79	
Land Charge	13.97		34.65		17.41		11.82		22.48*		23.89*	
Total Fixed Cost	39.62	46.5	75.10	50.6	47.02	43.5	35.18	44.4	60.52	50.8	59.16	51.7
Total Production Cost	85.22	100	148.38	100	108.14	100	79.16	100	119.22	100	114.50	100
Marketing Cost	30.46		37.37		35.60		33.92		25.10		25.10	
Total Cost	115.68		185.75		143.74		113.08		144.32		139.60	
Yield/Acre (bushels)	53.44		35.38		31.54		32.92		102.27		107.73	
Production Cost/bushel	2.17		3.77		2.75		2.01		3.03		2.91	
Marketing Cost/bushel	0.77		0.95		0.90		0.86		0.64		0.64	
Total Cost/bushel	2.94		4.72		3.65		2.87		3.67		3.55	
Exchange Rate (Currency/U.S. $)	0.89 Aus		CZ $13.84		R 2.54		26.28 B		$1.00		$1.00	

MT = metric ton.
*1985 land cost.

APPENDIX 2

PRODUCTION AND MARKETING COSTS OF WHEAT IN VARIOUS COUNTRIES (U.S. DOLLARS, MID-1986 PRICE LEVEL AND EXCHANGE RATE)

Particulars	ARGENTINA		BRAZIL		SOUTH AFRICA		UNITED STATES OVERALL		UNITED STATES CENTRAL PLAINS		CANADA		AUSTRALIA		UNITED KINGDOM	
Yield/Hectare(m. tons)	1.81		1.14		1.46		2.24		2.18		1.94		1.50		6.98	
Variable Costs	PER MT	%	PER MT	%	PER MT	%	PER MT	%	PER MT	%	PER MT	%	PER MT	%	PER MT	%
Seed	9.72		36.15		8.41		8.31		5.57		6.57		3.84		8.31	
Fertilizer and Lime	-		62.68		23.50		21.32		12.76		12.87		7.64		[illegible]	
Chemicals	4.98		63.75		8.26		[illegible]		1.34		7.62		6.68		13.92	
Custom Operations	11.49		-		2.71		6.13		7.34		0.85		11.46		4.37	
Fuel and Lube	[illegible]		32.93		14.44		13.80		12.92		9.65		10.81**		[illegible]	
Repairs	6.00		10.20		9.32		9.63		9.51		13.44				9.[illegible]	
Hired Labor	-		-		0.16		0.95		0.94		-		-		-	
Miscellaneous	-		10.51		7.69		0.91		0.26		2.09		-		3.23	
Interest on Variable Expenses	1.43		7.57		3.50		3.66		3.38		2.57		2.02		2.93	
Total Variable Cost	42.26	51.2	223.79	73.8	77.99	57.7	68.27	42.8	54.02	37.1	57.66	35.5	42.45	35.5	66.62	48.0
Fixed Costs																
General Farm Overhead	-		4.08		1.67		9.85		9.80		2.92		9.59		12.25	
Taxes and Insurance	5.97		2.21		1.26		9.51		10.46		7.09		3.36		-	
Capital Replacement	6.81		20.92		18.01		25.30		25.10		30.22		22.81		11.02	
Labor	7.11		8.44		6.97		11.69		11.10		15.71		7.56		15.70	
Interest on Nonland Capital	4.90		9.96		8.57		8.19		9.12		10.81		8.16		5.67	
Land Charge	15.55		33.75		20.64		26.67*		26.18*		37.92		25.55		27.39	
Total Fixed Cost	40.34	48.8	79.36	26.2	57.12	42.3	91.21	57.2	91.76	62.9	104.67	64.5	77.02	64.5	72.03	52.0
Total Production Cost	82.60	100	303.15	100	135.11	100	159.48	100	145.78	100	162.33	100	119.47	100	138.65	100
Marketing Cost	29.50		41.29		32.50		30.60		34.37		30.80		35.40		30.00	
Total Cost	112.10		344.44		167.61		190.08		180.15		193.13		154.87		168.65	
Yield/Acre (bushels)	26.81		16.92		21.67		33.25		32.42		28.76		22.27		103.62	
Production Cost/bushel	2.25		8.25		3.66		4.34		3.96		4.42		3.25		2.77	
Marketing Cost/bushel	0.80		1.12		0.88		0.83		0.94		0.84		0 97		0.82	
Total Cost/bushel	3.05		9.37		4.56		5.17		4.90		5.26		4.22		4.59	
Exchange rate (Currency/U.S. $)	0.89 Aus		CZ$13.84		R2.54		$1.00		$1.00		C$ 1.39		A $1.5[illegible]		0.66	

MT = metric ton
* = 1985 land cost
** includes fuel, lube and repairs

APPENDIX 3

PRODUCTION AND MARKETING COSTS OF SOYBEANS IN VARIOUS COUNTRIES (U.S. DOLLARS, MID-1986 PRICE LEVEL AND EXCHANGE RATE)

Particulars	ARGENTINA		BRAZIL				UNITED STATES			
			Double-crop/Wheat		Soybeans alone		OVERALL		LAKE STATES & CORN BELT	
Yield/Hectare (m. tons)	2.10		1.80		1.80		1.95		2.27	
	PER MT	%	PER MT	%	PER MT	%	PER MT	%	PER MT	%
Variable Costs										
Seed	16.31		14.57		14.57		12.87		11.30	
Fertilizer and Lime	-		50.90		55.04		13.04		8.33	
Chemicals	9.43		14.82		14.82		24.53		20.04	
Custom Operations	27.67		-		-		5.08		3.56	
Fuel and Lube	13.26		20.76		20.85		16.26		12.98	
Repairs	10.44		6.55		6.58		10.22		8.22	
Hired Labor	-		-		-		1.93		1.62	
Miscellaneous	-		5.89		6.09		0.37		0.29	
Interest on Variable Expenses	2.69		3.86		4.01		4.06		3.01	
Total Variable Cost	79.80	53.6	117.35	63.5	121.96	61.5	88.36	36.3	69.35	31.0
Fixed Costs										
General Farm Overhead	-		2.59		2.59		14.61		14.93	
Taxes and Insurance	13.82		3.27		4.67		15.96		18.08	
Capital Replacement	10.96		13.43		13.49		33.07		30.15	
Labor	13.87		6.45		6.48		16.68		13.79	
Interest on Nonland Capital	8.10		6.46		6.48		11.51		10.59	
Land Charge	22.35		35.25		42.74		62.95*		67.06*	
Total Fixed Cost	69.10	46.4	67.45	36.5	76.45	38.5	154.78	63.7	154.60	69.0
Total Production Cost	148.90	100	184.80	100	198.41	100	243.14	100	223.95	100
Marketing Cost	36.14		43.50		43.50		24.60		24.60	
Total Cost	185.04		228.30		241.91		267.74		248.55	
Yield/Acre (bushels)	31.24		26.78		26.78		28.95		33.70	
Production Cost/bushel	4.05		5.03		5.40		6.62		6.10	
Marketing Cost/bushel	0.99		1.18		1.18		0.67		0.67	
Total Cost/bushel	5.04		6.21		6.58		7.29		6.77	
Exchange Rate (Currency/U.S.$)	0.89Aus		CZ$13.84		CZ$13.84		$1.00		$1.00	

MT = metric ton
* = 1985 land cost